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Notes:

1. Untranslatable words are replaced with asterisks (\*\*\*)�.
2. Texts in the figures are not translated and shown as it is.

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Dictionary: Last updated 12/10/2008 / Priority: 1. Chemistry / 2. Fiber/Clothing material

[Document Name] Description

[Title of the Invention] The fiber structure thing which uses a Plastic solid and it

[Claim(s)]

[Claim 1] In the Plastic solid which it comes to consist of photocatalyst semiconductor grains and a support layer containing this These a part of photocatalyst semiconductor grains [ at least ] are exposed to this Plastic solid surface. and the organic substance on this surface of a Plastic solid defined as the text -- a resolution -- the Plastic solid characterized by the weight loss under the UV irradiation of 10 mw/cm<sup>2</sup> being 1micro more than g/cm<sup>2</sup>/hour when power applies salad oil by 0.1 mg/cm<sup>2</sup>.

[Claim 2] The Plastic solid according to claim 1 whose content of these photocatalyst semiconductor grains is this 5 to 70weight % of Plastic solid weight.

[Claim 3] The molding body according to claim 1 to 2 this whose photocatalyst semiconductor grain is titanium oxide.

[Claim 4] The molding body according to claim 3 which is titanium oxide in which this titanium oxide carried out the surface modification.

[Claim 5] The Plastic solid according to claim 1 which is what has the character in which the quantity of this Plastic solid is decreased from a surface by at least one sort of means chosen from the physical means and the chemical means.

[Claim 6] The Plastic solid according to claim 5 this whose chemical means is at least one sort chosen from embrittlement, decomposition, and the dissolution.

[Claim 7] The Plastic solid according to claim 6 which is a hydrolysis according [ this decomposition ] to an alkali.

[Claim 8] The Plastic solid according to claim 7 which is what this physical means depends on mechanical polishing.

[Claim 9] The Plastic solid according to claim 5 to 8 with which the average unevenness difference of this Plastic solid surface part is characterized by 0.5-micrometer or more being 30 micrometers or less.

[Claim 10] The Plastic solid according to claim 1 this whose support layer is a product made of a synthetic resin.

[Claim 11] The Plastic solid according to claim 10 this whose synthetic resin is at least one sort chosen from polyester resin, urethane resin, an acrylate resin, olefine resin, vinyl chloride resin, a fluororesin, silicone resine, epoxy resins, and these modified resins.

[Claim 12] The Plastic solid according to claim 11 this whose modified resin is a copolymer.

[Claim 13] The Plastic solid according to claim 12 this whose synthetic resin is thermoplasticity.

[Claim 14] The fiber structure thing which arranges a Plastic solid according to claim 1 to 13 at least on one side, and carries out the feature of the things.

#### [Detailed Description of the Invention]

##### [0001]

[Field of the Invention] Especially this invention relates to fiber structure things which use a Plastic solid and it excellent in the antifouling property at the time of outdoor use, such as antifouling, antibacterial properties, and deodorization.

##### [0002]

[Description of the Prior Art] The coating agent containing a photocatalyst body, the product which applied it, and its pertinent art are examined by various uses in order to use for antifouling,

antibacterial properties, deodorization, etc. the powerful oxidative degradation which occurs by carrying out light excitation of the photocatalyst body by ultraviolet radiation in recent years. Also in the roof of the tent warehouse mainly used outdoors, the ornament sheet for stores, an eaves broth tent, etc. The soil by the pollutant in the air adheres temporally from before, there is a problem which causes an appearance fall, the soil component of the organic substance which adhered by the photolysis is decomposed, and the trial which is going to utilize effectively a self-consecration operation of the photocatalyst of washing away by a rainfall, and is going to increase antifouling property is examined. However, since various environmental factors are entangled, the mechanism of contamination of a pollutant adhering and becoming dirty temporally cannot say that the relation between clear catalytic activity and antifouling property is clear.

[0003]

[Problem to be solved by the invention] the fiber structure thing which uses the Plastic solid and it which excelled [ this invention ] in handling nature in view of the background of this conventional technology, and were excellent in antifouling property -- it is going to provide -- it is a thing.

[0004]

[Means for solving problem] The following means are used for this invention in order to solve this technical problem. Namely, the Plastic solid of this invention is set to the Plastic solid which it comes to consist of catalyst semiconductor grains and a support layer containing this. These a part of photocatalyst semiconductor grains [ at least ] are exposed to this Plastic solid surface. and the organic substance on this surface of a Plastic solid defined as the text -- a resolution -- when power applies salad oil by 0.1 mg/cm<sup>2</sup>, it is characterized by the weight loss under the UV irradiation of 10 mw/cm<sup>2</sup> being 1micro more than g/cm<sup>2</sup>/hour.

[0005]

[Mode for carrying out the invention] This invention examines wholeheartedly the Mitsunari form which was excellent in said technical problem, i.e., handling nature, and was excellent in antifouling property, and when a part of photocatalyst semiconductor grains [ at least ] contained in the Plastic solid adopt the means exposed on this Plastic solid surface, it studies solving this technical problem at once.

[0006] Although there are no restrictions in particular in the production method of the Plastic solid containing the photocatalyst semiconductor grains of this invention A photocatalyst grain and its dispersion liquid For example, an acrylate resin, acrylic silicone resine, The body or its mixture may be distributed at the time of inorganic system \*\*, such as the body and silica metallurgy group alkoxide, at the time of organic system \*\*, such as epoxy silicone resine, a silicon modified resin, urethane resin, an epoxy resin, polyester resin, and an alkyd resin, and the dispersion liquid may be applied to a base material, it may dry, and a Plastic solid may be acquired. Between a base

material and a Plastic solid, you may prepare an intermediate layer for the purpose of the superiors for adhesion.

[0007] moreover, the thermoplastics containing photocatalyst grains, such as polyethylene, polypropylene, polystyrene, polyvinyl chloride, and polyester resin, -- blow molding -- injection molding may be carried out and you may fabricate in arbitrary form. The method of scouring a photocatalyst to resin and carrying out spinning to it is also included in this. However, especially in the time of outdoor use, in order to heighten the antifouling effect by self-consecration, this invention found out that it was important that photocatalyst grains are exposed to this Plastic solid surface.

[0008] the organic substance according to the light excitation on this surface of a Plastic solid by having exposed -- a resolution -- [ power ] When applied to the surface by 0.1 mg/cm<sup>2</sup>, the following conditions, i.e., salad oil, the weight loss under the UV irradiation of 10 mw/cm<sup>2</sup> -- 1 micro g/cm<sup>2</sup>/hour it is 40micro more than g/cm<sup>2</sup>/hour that it is above still more desirably 10micro more than g/cm<sup>2</sup>/hour at best still more desirably -- it is desirable. It is for the lightness fall (deltaL) by a soil [ in / that weight loss is 1micro more than g/cm<sup>2</sup>/hour / an outdoor exposure examination ] not to become dirty easily small to what does not contain a photocatalyst. Organic substance decomposition capability is defined by the following methods, for example. That is, the <organic substance decomposition capability> photocatalyst semiconductor grain content layer was cut into 2.5cm x 5cm, and it pasted up with the double-sided tape so that a photocatalyst containing layer might come out on the surface on slide glass 2.6cmx7cm. On the surface of the photocatalyst containing layer, salad oil (made by the Nissin Oil Mills, Ltd.) was applied so that it might become [ two ] in 0.1mg/cm. It is put in into the black light (made by a great Japan plastics company) adjusted so that UV irradiation hardness might be set to 10 mw/cm<sup>2</sup>. carrying out 5 time tests of the minute reduction of the weight in every hour, measuring the reduction weight per 2 or hour 1cm, and passing along the starting point as initial inclination -- the inclination of the primary approximate expression by 2 hours -- an organic substance -- a resolution -- it was considered as power and wrote in the time of mug/cm<sup>2</sup>. It is shown that organic substance decomposition capability is so high that the absolute value of initial inclination is large.

[0009] Salad oil is an example of an organic substance, there are no restrictions in particular, it is the mixture of oleum rapae and soybean oil well from common edible-plants oil, and 15 to 50% of an oil impregnation component, the iodine numbers 130-150, a fusing point and congealing point-8-0 degree C, and the saponification value 114-180 are typical.

[0010] However, since there is a possibility of causing deterioration of a binder when organic substance decomposition capability is too strong Furthermore, the weight loss of the Plastic solid when being in the state which is not desirably applied to the surface at all, and glaring the ultraviolet radiation of 10 mw/cm<sup>2</sup> itself is 10micro g/cm<sup>2</sup>/hour. It is desirable hereafter that it is 1micro less than g/cm<sup>2</sup>/hour still more desirably.

[0011] As for the content of photocatalyst semiconductor grains, it is desirable that it is 5 to 70% of Plastic solid full weight. It is because coat formation will become difficult if too large [ if too small,

light catalytic will be hard to be obtained, and ].

[0012] The photocatalyst semiconductor grains of this invention are grains which will discover a photocatalyst function if the light of wavelength with the energy more than the band gap is glared. TiO<sub>2</sub>, ZnO, SrTiO<sub>3</sub>, CdS, GaP, InP, GaAs, BaTiO<sub>3</sub>, K<sub>2</sub>, NbO<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, Ta<sub>2</sub>O<sub>5</sub>, WO<sub>3</sub>, SnO<sub>2</sub>, Bi<sub>2</sub>O<sub>3</sub>, NiO, Cu<sub>2</sub>O, SiC, SiO<sub>2</sub>, MoS<sub>2</sub>, InPb, RuO<sub>2</sub>, CeO<sub>2</sub> A metal and metal oxides, such as Pt, Rh, RuO<sub>2</sub>, Nb, Cu, Sn, nickel, and Fe, can be used combining singleness or two sorts or more. Moreover, since antibacterial properties and antifungal nature are raised further, adding Ag, the inorganic system metal antibacteria medicine of Cu and Zn, zinc pilus thione, and the organic system antibacteria medicine of benzimidazole \*\* can also be used preferably.

[0013] As photocatalyst grains, especially titanium oxide has high photocatalyst ability, and is chemically stable, and since it is harmless, it is desirable. Anatase type, rutile type, and bull KAITO type any are sufficient as the crystal system of titanium oxide, and these mixtures are sufficient as it again. Moreover, the titanium oxide which carried out the surface modification can also be used preferably. With the titanium oxide which carried out the surface modification, what covered the surface in part at least by silica, alumina, silica alumina, zinc oxide, an apatite, PTFE resin, etc. is included. For example, what covered the photocatalyst with porosity inorganic substances, such as silica, can be used preferably. About 5-1000A is desirable still more desirable, and, as for the hole diameter of the enveloping layer which consists of a porosity inorganic substance, 100-300A is good. It is for a pollutant not to reach a photocatalyst, if small [ if an aperture is large, titanium oxide will contact a base material directly and special binder protection nature will be lost, and ]. Although the titanium oxide which carried out the surface modification had the outstanding point that decomposition of \*\*\*\*\* could be suppressed in this way and broad \*\*\*\*\* could be used, in the former, catalytic activity, such as a self-consecration operation by a photocatalyst, could not but decrease to some extent. If the surface of photocatalyst semiconductor grains is exposed like this invention, it can be especially used preferably from catalytic activity sufficient also with the titanium oxide which carried out the surface modification being obtained. Furthermore, since titanium oxide has ultraviolet absorption ability, although the difference was produced also in deterioration by the sunlight of \*\*\*\*\* and it was made to expose to it in the same amount of titanium oxide addition in the thing to which the surface was made not to expose, it also has the special feature that a direction cannot yellow easily.

[0014] Thus, in order for titanium oxide to obtain what was exposed to the Plastic solid surface, it is desirable for a support layer especially to be what has the character the quantity of is decreased from a surface by at least one sort of means chosen from the physical means and the chemical means. This is because the surface of photocatalyst semiconductor grains can be exposed on the Plastic solid surface before making it decrease by reducing one's weight from a surface by at least one sort of means chosen from the physical means and the chemical means, after forming a Plastic solid. Since the amount of photocatalyst addition can be reduced by this method, plasticity can improve and the Plastic solid excellent in handling can be acquired.

[0015] As a chemical means by which the quantity of the surface can be decreased, methods, such as embrittlement, decomposition, and the dissolution, are desirable. For example, \*\*\*\*\* which the quantity of polyester, polylactic acid, polyvinyl alcohol, soluble water glass, and a metal content

hydrolysis nature acrylate resin etc. is easy to decrease, After mixing photocatalyst semiconductor grains and applying and drying to a base material, water (warm water \*\*\*), an alkali, an acid, etc. may be contacted by the method of immersion, a spray, etc., the quantity of a surface coat may be decreased, and photocatalyst semiconductor grains may be exposed.

[0016] Moreover, even if a dissolution (decomposition) velocity differential with \*\*\*\*\* the quantity of is easy to decrease uses together \*\*\*\*\* is large and the quantity of is hard to decrease in order to control loss in quantity of a surface coat, it does not interfere. It elaborates on such an exposure method, and it is crowded and can use photocatalyst semiconductor grains preferably especially to the raw thread and sheath-core yarn which carried out spinning. As the spinning method of such yarn, photocatalyst semiconductor grains may be scoured to thermoplastic polymer, melting and the polymer carry out spinning and the quantity of is hard to decrease may be used as a heart component, and sheath-core yarn may be manufactured at a sheath component by making into a mixture photocatalyst grains and the polymer the quantity of is easy to decrease. Thus, the obtained photocatalyst content yarn can be included even in the common garments use asked for example, for antibacterial properties and deodorization nature as well as industrial materials, such as an outdoor tent fabric and a sheet ground, and can be used widely. The clothes which use the fiber which uses the binder which fine-dissolves especially under fine alkali environment can expose the photocatalyst semiconductor grain surface also in home wash, and can discover an effect very simple. Moreover, the surface can be made to be able to update and the effect of a photocatalyst can also be made to maintain over a long period of time by repeating wash repeatedly.

[0017] Abrasive paper processing which may carry out mechanical polishing of the surface, for example, grinds the surface with abrasive paper, such as a sandpaper, as a physical means on the other hand. An abrasive compound is temporarily held by media, such as fats and oils, at the peripheral face using the buff constituted by plasticity materials, such as a cheesecloth, sisal, leather, and felt, as a body of revolution. Polishing which carries out minute grinding of the surface of a workpiece with the pressure which acts between the buff and workpiece which are high-speed and rotate, A medium, water, and a workpiece are put in into a barrel layer, and the brass and processing which project projection material, such as barrel finishing ground by rotation and vibration, and a glass bead, a steel shot, with blasting machines, such as a centrifugal projection type and an air acceleration type, and perform a surface treatment are included. Of course, it is also effective to perform mechanical polishing to yarn.

[0018] Moreover, it is still more desirable for the average unevenness difference of a Plastic solid surface part to be 0.5 micrometers or more 30 micrometers or less. It is for becoming easy to accumulate a contamination component in a slot, if it will be hard to utilize photocatalyst activity since the exposure area of the photocatalyst to the surface is small if an uneven difference is too small, and an uneven difference is too large.

[0019] It is desirable that it is a synthetic resin, it is excellent in flexibility that it is one sort chosen from polyester resin, urethane resin, an acrylate resin, olefine resin, vinyl chloride resin, a fluororesin, silicone resine, and these modified resins, and the layer containing photocatalyst semiconductor grains has it. [desirable ]

[0020] It is desirable that it is a copolymer as a modified resin, for example, it is effective especially in order that an acrylic silicon copolymer may prevent the base material deterioration by adhesion and a photocatalyst with a base material. Endurance can be raised by mixing an optical stabilizing agent, an ultraviolet ray absorbent, etc. in order to suppress deterioration by photocatalyst operation of such \*\*\*\*\*. As light stabilizer, succinate dimethyl and 1-(2-hydroxyethyl)-4-hydroxy 2, 2', As the HINDATO amine system and ultraviolet ray absorbent which catch radicals, such as a 6 and 6'-tetramethylpiperidine polycondensation thing, and prevent deterioration of resin, triazole systems, such as 2-(5-methyl 2-hydroxyphenyl) benzotriazol, etc. can be used.

[0021] [ the Plastic solid by this invention ] by arranging by coating etc. at least at one side on the resin sheet which coated with resin the textile fabrics which consist of fiber, such as a sheet-like fiber structure thing, for example, polyester, and nylon, and these textile fabrics Moreover, by fabricating a Plastic solid in the shape of a film, and pasting together at least to one side of textile fabrics As a general structural material, especially, for example The hood of transporter instruments, such as a roof of a tent warehouse, and a truck sheet, The cover of the side of the roof of a piling-up-out-in-the-open sheet, the ornament sheet for stores, an eaves broth tent, and various arcades, the pavilion of a show, etc., a waterproofing protection sheet, a protection-against-snow sheet, an air dome, a pool cover, etc. can be used widely, and since a state with the beautiful surface is held over a long period of time, it can be used preferably.

[0022] Since equipment, such as a high frequency welder and Leister, is used for the fiber structure thing used for these uses and sewing is carried out by thermal melting arrival in many cases, it is desirable for the support layer containing a photocatalyst to be a thermoplastic synthetic resin.

[0023] This invention is explained using Drawings. Drawing 1 is chemical and the \*\* type sectional view showing signs that photocatalyst semiconductor grains are further exposed with a physical method in the Plastic solid which the photocatalyst semiconductor grains of 1 contain in the support layer of 2.

[0024] When, as for drawing 2, salad oil is applied to the surface by 0.1 mg/cm<sup>2</sup> at this invention at a work-example top, the weight loss under the UV irradiation of 10 mw/cm<sup>2</sup> is shown, and A of the code in a figure, B, C, D, E, and F show the weight loss of work examples 1, 2, 3, 4, 5, and 6, respectively.

[0025] When, as for drawing 3, salad oil is applied to the surface by 0.1 mg/cm<sup>2</sup> at a comparative example top, the weight loss under the UV irradiation of 10 mw/cm<sup>2</sup> is shown, and G of the code in a figure, H, I, and J show the weight loss of comparative examples 1, 2, 3, and 4, respectively.

[0026]

[Working example] A work example explains this invention still in detail hereafter.

[0027] In addition, the value in performance shown in a work example and a comparative example was measured by the following method. The <organic substance decomposition capability> photocatalyst semiconductor grain content layer was cut into 2.5cm x 5cm, and it pasted up with the double-sided tape so that a photocatalyst containing layer might come out on the surface on slide glass 2.6cmx7cm. On the surface of the photocatalyst containing layer, salad oil (made by the Nisshin Oil Mills, Ltd.) was applied so that it might become [ two ] in 0.1mg/cm. It is put in into the black light (made by a great Japan plastics company) adjusted so that UV irradiation hardness might be set to 10 mw/cm<sup>2</sup>. carrying out 5 time tests of the minute reduction of the weight in every hour, measuring the reduction weight per 2 or hour 1cm, and passing along the starting point as initial inclination -- the inclination of the primary approximate expression by 2 hours -- an organic substance -- a resolution -- it was considered as power and wrote in the time of mug/cm<sup>2</sup>/h. It is shown that organic substance decomposition capability is so high that the absolute value of initial inclination is large. It is JIS about <antifouling property> outdoor exposure stain testing. A It carried out for 30 days by the method specified to 1410, lightness (L value) was measured for the surface of the sheet before contamination, and the sheet after exposure by the digital colorimetry color difference computer (made by Suga Test Instruments Co., Ltd.), and the grade of contamination was searched for by the following formula. It can be said that the fall of lightness is small excellent in antifouling property, so that the value of deltaL is small.

[0028] antifouling property: -- deltaL=A-B -- here, A: The L value B before stain testing : the 20% of L value work-example 1 solid content silicone coating agent (Dow Corning Toray Silicone Co. Ltd. SR2410) 5 weight part after outdoor exposure, and TiO<sub>2</sub> minute 15% of a solvent distributed titanium oxide solution (Sumitomo Osaka Cement ) PCT-15T 6.7 weight parts were mixed, it dried in spreading, and 130 degree-Cx 5 minutes by bar KOTA on one side of the 50-micron-thick polyester film, and the work example 1 was acquired. The solid content of titanium oxide to the binder resin solid content 1 was 1. Organic substance decomposition capability was 20micro g/cm<sup>2</sup>/hour.

[0029] About 10 microns of surfaces of work-example 2 work example 1 were ground with abrasive paper (Nihon Kenshi Co., Ltd. make CC2000-Cw), and the work example 2 was acquired. Organic substance decomposition capability was 21micro g/cm<sup>2</sup>/hour.

A 30% of work-example 3 solid content polyester resin coating agent (Toyobo Co., Ltd. make Byron 20SS) 10 weight part and 3g of titanium oxide particles (ISHIHARA SANGYO KAISHA LTD. ST-01) were mixed, it applied and dried to the polyester film like the work example 1, and the work example 3 was acquired. The solid content of titanium oxide to the binder resin solid content 1 was 1. Organic substance decomposition capability was 20micro g/cm<sup>2</sup>/hour.

The film obtained in the work-example 4 work example 3 was immersed in the sodium hydroxide aqueous solution 3% for 24 hours, and the polyester resin surface was hydrolyzed. The film was pulled up, it washed and dried and the work example 4 was acquired. Organic substance decomposition capability was 22.5micro g/cm<sup>2</sup>/hour.

The polyester resin coating agent 10 weight part of work-example 5 work example 3 and 3g of surface silica modification titanium oxide particles (mean-particle-diameter [ of 4 microns ] specific surface area of 540 microns) were mixed, and it applied and dried to the polyester film like the work example 1. The solid content of titanium oxide to the binder resin solid content 1 was 1. The film

was immersed in the sodium hydroxide aqueous solution 3% like the work example 4 for 24 hours, and polyester resin was hydrolyzed. The film was pulled up, it washed and dried and the work example 5 was acquired. Organic substance decomposition capability was 9micro g/cm<sup>2</sup>/hour. Surface silica modification titanium oxide 2.5 weight \*\*\*\* of the work example 5 was mixed in the 25% of work-example 6 solid content urethane resin coating agent ( Chris Bon NY331 by Dainippon Ink, Inc.) 10 weight part, and it applied and dried to the polyester film like the work example 1. The solid content of titanium oxide to the binder resin solid content 1 was 1. About 10 microns of the film was ground like the work example 2, and the work example 6 was acquired. Organic substance decomposition capability was 11micro g/cm<sup>2</sup>/hour.

The silicone coating agent 10 weight part of comparative example 1 work example 1 and the titanium oxide particle 2 weight part of the work example 3 were mixed, it applied and dried to the polyester film like the work example 1, and the comparative example 1 was acquired. The solid content of titanium oxide to the binder resin solid content 1 was 1. Organic substance decomposition capability was 0.5micro g/cm<sup>2</sup>/hour.

The titanium oxide coating film before comparative example 2 work example 5 hydrolyzes was made into the comparative example 2. Organic substance decomposition capability was 0.9micro g/cm<sup>2</sup>/hour.

The titanium oxide coating film before comparative example 3 work example 6 grinds was made into the comparative example 3. Organic substance decomposition capability was 0.5micro g/cm<sup>2</sup>/hour.

The 50-micron polyester film used in the comparative example 4 work example was made into the comparative example 4. Organic substance decomposition capability was 0.005micro g/cm<sup>2</sup>/hour. the organic substance of work examples 1-6 and comparative examples 1-4 -- a resolution -- power and antifouling property are shown in Table 1.

[0030]

[Table 1]

[0031] It can be said that the thing of work examples 1-6 has the antifouling property in which fall deltaL of lightness was all small excellent compared with the thing of comparative examples 1-4.

[0032]

[Effect of the Invention] The fiber structure thing which uses the Plastic solid of this invention and it is preferably used for all the life materials and industrial materials from which antifouling by a photocatalyst, deodorization, and an antibacterial effect are expected. The hood of transporter instruments, such as a roof of the tent warehouse excellent in especially the antifouling property at the time of outdoor use, and a truck sheet, especially, The cover of the side of the roof of a piling-up-out-in-the-open sheet, the ornament sheet for stores, an eaves broth tent, and various arcades, the pavilion of a show, etc., a waterproofing protection sheet, a protection-against-snow

sheet, an air dome, a pool cover, etc. can be used widely, and since a state with the beautiful surface is held over a long period of time, it can be used preferably.

[Brief Description of the Drawings]

[Drawing 1] This figure is a \*\* type sectional view of a Plastic solid.

[Drawing 2] This figure shows the organic substance resolvability of a work example.

[Drawing 3] This figure shows the organic substance resolvability of a comparative example.

[Explanations of letters or numerals] 1: photocatalyst semiconductor grain 2:support layer  
A:work-example 1B: -- a work example -- 2C:work-example 3D:work-example 4E:work-example 5F:  
-- a work example -- 6G:comparative example 1H:comparative example 1I:comparative example  
3J: -- a comparative example 4

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[Translation done.]